

Did Cash Holding Affect Firm Performance During the Covid-19 Pandemic? The Role of Women CEOs

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Abstract: *The Covid-19 crisis led to severe financial challenges for companies, with many struggling to meet their financial obligations due to insufficient cash flow. This paper examines the effect of corporate cash holdings on firm performance during the Covid-19 pandemic. The influence of women CEOs on corporate cash holdings and firm performance during this difficult period was also investigated. By using a cross-sectional ordinary least squares (OLS) regression approach, it was found that a sample of 624 Malaysian listed firms had higher cash holdings in 2019, which contributed positively to firm performance in 2020. Despite women CEOs holding less cash on average, their cash management practices during the pandemic improved firm performance compared to their male counterparts. However, the interaction between cash holdings and female CEO becomes insignificant when firm performance is analysed in 2021. The findings of this study suggest important policy implications, especially in promoting gender diversity in top management, as female leadership can contribute to firm survival and performance during periods of extreme distress. This study extends the literature on corporate cash management and gender-based differences in executive decision-making, which provides empirical evidence on the role of female CEOs in crisis management.*

Keywords: Firm performance; Cash holding; Women CEO; Covid-19; Risk-taking
JEL Classification: G14, G32, G34

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1. Introduction

Covid-19, the viral disease caused by the SARS-CoV-2 virus, emerged in late 2019. It spread rapidly around the globe, causing millions of deaths and long-term disruptions in global trade and businesses. The ripple effect of the pandemic is still unfolding around the world. Many companies were hit hard, with a substantial number filing for bankruptcy as the crisis hit. More than 37,000 companies in Malaysia were forced to close during the pandemic (Augustin, 2021). The impact of this closure of businesses in turn led to high unemployment and individual bankruptcies during this period.

Malaysia was struggling to confront the Covid-19 crisis due to the slowdown of economic activities caused by the on-and-off lockdown measures to halt the outbreak of the virus. Many companies struggled to meet their financial obligations due to insufficient cash flow to cover fixed costs, such as rentals, utilities, and employee salaries. Consequently, many businesses ended up shuttering. A 2020 survey conducted by the Department of Statistics Malaysia (DOSM) reported that 67.8% of companies had no income during the lockdown period, while 68.9% relied heavily on savings to sustain their business operating costs (DOSM, 2020). Many large, long-established corporations ran into trouble due to weak cash management. The Covid-19 crisis—which may prolong into the near future—has made it imperative to have solid control of cash management, which will strengthen the financial position of businesses and sustainability to boost national economic growth.

Gender diversity on corporate boards is widely regarded as essential for company growth and success. However, the outbreak of the Covid-19 pandemic exacerbated the gender gap and continued undermining women's empowerment in terms of business growth and economic development. Despite the United Nations' Sustainable Development Goals (SDG) emphasising the participation of the women in the economy, their involvement is still far from parity (UN Women, 2021). The UN Women report indicates that the global average of women's participation in the labour force is approximately 39%, and their representation in managerial positions is only 28.2%. This is despite prior studies (e.g., McInerney-Lacombe et al., 2008) suggesting that female CEOs possess the right qualities to implement prudent risk management in the corporate sector. Some attribute this to biological factors (Saad & Gill, 2000), or

psychological and social factors (Meier-Pesti & Penz, 2008). Women CEOs are also found to be diligent and meticulous when monitoring corporate risk-taking (Lai et al., 2017).

The International Labour Organisation (ILO, 2015) states that women representation on corporate boards can strengthen financial performance, foster better decision-making, enhance consumer insight, improve corporate governance, and cultivate talent in a company. Indeed, gender diversity on corporate boards is becoming increasingly important for businesses to grow and prosper. For example, Joy et al. (2011) report that companies with three or more women on the board performed better than companies with fewer women. Nevertheless, women continue to be underrepresented on corporate boards, making up only 19% of global boards and less than 5% of CEOs amongst the world's largest companies.

In the Malaysian context, Tee and Kasipillai (2022) show that from 2005 to 2015, the mean average of female directors was only 6% on Malaysian corporate boards and 5% on audit committees, indicating that male directors overwhelmingly dominated Malaysian corporate boards at the time. Furthermore, according to the World Bank, only 13.8% of Malaysian board positions were represented by women, falling short of the global average (Amin & Tan, 2018). After recognising the advantages of involving women on corporate boards, the Securities Commission's (SC, 2021) Malaysian Code on Corporate Governance (MCCG) advocated for all listed companies in Malaysia to aim for a board composition of at least 30% women directors. According to the SC (2022), the participation of women on boards across all listed companies increased by 8.5% from 2016 to 2022. While this recent initiative by the SC is laudable, evidence must be obtained to ascertain the positive contribution of women directors, particularly in corporate risk-taking.

The ongoing Covid-19 pandemic provides a suitable case study to examine the contribution of women CEOs in terms of corporate risk-taking and corporate liquidity. This pandemic not only altered the landscape of doing business, but also changed how risk-taking was perceived by senior management in the face of liquidity crunch and business uncertainties. As the pandemic shows no sign of abating, prudent risk management and corporate cash holdings have been identified as key elements in ensuring the sustainability and competitiveness of firms. Therefore, an empirical study is required to substantiate the potential contribution of female directors in the

Malaysian corporate sector. A positive outcome would certainly influence corporate boards, institutional investors, and regulators in Malaysia to promote higher gender diversity and break the ‘old boys’ network, which tends to avoid critical group thinking on unpalatable issues.

Given the unprecedented impact of Covid-19 on the economy and businesses, this study aims to investigate how corporate decisions regarding cash holdings during the pandemic would influence post-pandemic firm performance. On top of that, the literature indicates that female executives often maintain high levels of liquid reserves to ensure financial flexibility, safeguard normal operations, avoid unfavourable consequences, and mitigate the risks of liquidity deficits and cash flow volatility (Bernile et al., 2018; Faccio et al., 2016; Lins et al., 2010; Dittmar et al., 2003). Building on this notion, this study will examine if female CEOs held more cash than their male counterparts during the Covid-19 pandemic, and whether this contributed positively to firm performance in the post-pandemic period. In short, the present study will examine the relation between corporate cash holdings during the pandemic and subsequent firm performance, and how women’s leadership in top management, particularly female CEOs, influences corporate liquidity and firm performance during difficult times.

This study contributes to the existing literature on corporate finance by extending the theoretical framework on corporate cash management and its impact on firm performance during crisis periods. It also extends upper echelons literature by providing empirical evidence on the role of female CEOs in influencing firm performance through their decisions on cash management during the Covid-19 pandemic. Additionally, the findings offer insights into gender-based differences in corporate decision-making, specifically on corporate cash holdings, adding a new perspective to the discourse on women’s leadership in managing firm survival during challenging times.

This paper is organised as follows. Section 2 reviews relevant literature and theories. Section 3 outlines the methodology employed, including the data sources and research models used in this study. Section 4 presents results and discussion of empirical findings. Section 5 concludes with a summary of key findings, policy implications, and the limitations of this study, followed by recommendations for future research.

2. Literature Review

2.1 Theoretical framework

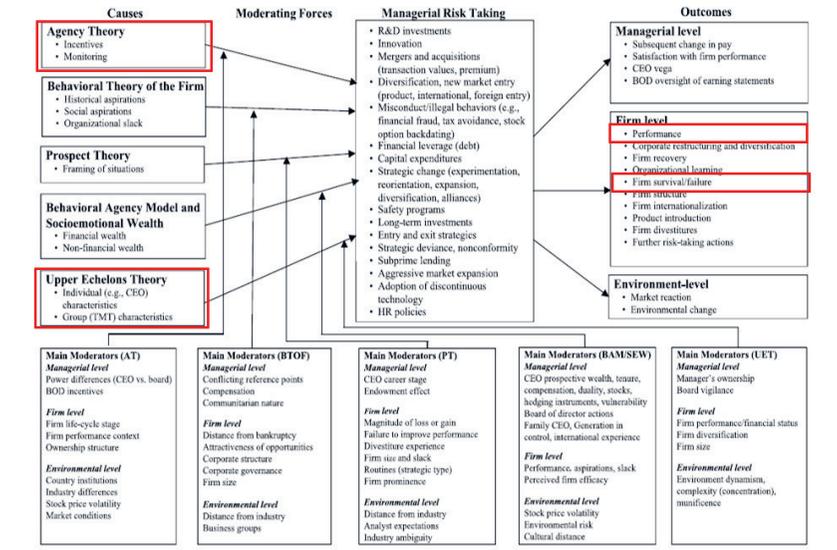
This study developed a theoretical framework to explain firm survivorship. The managerial risk-taking literature summarised by Hoskisson et al. (2017) is presented in Figure 1 below. Firm survivorship is one of the outcomes of managerial risk-taking, which can be explained by five theories: agency theory, behavioural theory of the firm, prospect theory, behavioural agency model and socioemotional wealth, as well as upper echelons theory. These theories explain the motive of managerial risk-taking behaviours from different perspectives, and how these motives could be affected by different business settings and environments at the managerial, firm and environmental levels.

According to Hoskisson et al. (2017), agency theory posits that the conflict of interest between managers (agents) and shareholders (principals) often leads to risk-averse behaviours in the former, unless incentivised to align with shareholders' risk-taking preferences. The behavioural theory of the firm suggests that firms engage in risk-taking behaviour based on their performance relative to their aspirations. Underperformance tends to lead firms to seek higher risk, while overperformance tends to result in risk aversion. Prospect theory, meanwhile, asserts that individuals are more sensitive to potential losses than equivalent gains, influencing their risk behaviour based on their perceived reference points. When individuals are below a reference point, they will engage in higher-risk behaviour, while individuals who are above the reference point are more unlikely to take risks. The behavioural agency model integrates agency theory with behavioural insights, underscoring how managerial compensation and potential wealth shape managers' risk-taking decisions. Socioemotional wealth further highlights that family-owned companies prioritise non-financial goals, leading to more conservative strategic decisions to avoid losses. Finally, upper echelons theory suggests that executives' personal traits, experiences, and values influence their strategic decisions, including risk-taking behaviours.

Within the framework of Hoskisson et al. (2017), there is a research gap in which cash flow management is not mentioned as a form of managerial risk-taking. However, after the 2008 sub-prime crisis and the

recent Covid-19 lockdowns, cash flow sustainability has been identified as playing a key role in determining firm survivorship during periods of extreme financial distress. The measures of managerial risk-taking covered in this framework are firm policies under normal circumstances, but are not relevant to periods of extreme financial distress. In this study, the Hoskisson et al. (2017) framework is extended to show how cash management can be an important factor in firm survivorship under such conditions. Furthermore, based on the liquidity preference theory advocated by Keynes (1936), money demand has three motives: transaction, precautionary and speculative. In corporate finance, the trade-off theory on free cash flow states that a firm would minimise the holding of free cash flow, as it is deemed unproductive. However, a firm may also consider holding sufficient free cash to hedge against recession, which is consistent with the precautionary motive of money demand (Opler et al., 1999).

Figure 1: Theoretical framework of managerial risk-taking



Note: CEO = chief executive officer; TMT = top management team; AT = agency theory; BOD = board of directors; BTOF = behavioral theory of the firm; R&D = research and development; HR = human resources; PT = prospect theory; BAM = behavioral agency model; SEW = socioemotional wealth; UET = upper echelons theory.

Xu et al. (2019) state that there are two competing theories to explain how women directors or CEOs would treat cash management. The first argues that women are relatively more conservative, less confident and

risk-averse, meaning that they are likely to hold more cash and show more support for precautionary behaviour. On the other hand, agency theory argues that women prefer to hold less cash, as they have relatively higher ethical values than men (Doan & Iskandar-Datta, 2019; Pierce & Sweeney, 2010). As such, the theoretical framework of Hoskisson et al. (2017) was improved by introducing cash flow management as a form of risk-taking to explain firm performance in sustaining business performance over the pandemic era, i.e., survivorship.

2.2 Research hypotheses

The first hypothesis is that cash holding will improve firm performance (and thus survivorship) during the Covid-19 era. Following Keynes' (1936) liquidity preference theory, holding cash has two main benefits. Firstly, having cash reserves would prevent firms from liquidating their assets and paying expensive transaction costs that arise from fundraising due to information asymmetries (Myers, 1984; Myers & Mjiluf, 1984). These benefits explain the transaction motive of hoarding cash. Secondly, cash reserves allow firms to seize future growth opportunities ahead of their competitors and safeguard themselves from unexpected shocks, such as financial crises (Bates et al., 2009; Ozkan & Ozkan, 2004; Almeida et al., 2004). Cash reserves not only help firms lower the possibility of financial distress, but also enjoy greater financial flexibility and lower transaction costs, which results in better firm performance (Fresard, 2010; Kalcheva & Lins, 2007; Pinkowitz et al., 2006). These explain the precautionary and speculative motives of firms to hold more cash.

However, there is a 'dark side' behind cash reserves. Based on the free cash flow theory (Jensen, 1986), holding excess cash reserves would induce managers to pursue their personal goals at the expense of shareholders. The opportunistic behaviour of managers would deteriorate firm performance (Huang et al., 2013; Oler & Waegelien, 2011; Dittmar & Mahrt-Smith, 2007; Luo & Hachiya, 2005). This controversial argument makes the determination of the relation between cash holding and firm performance a challenge. Nevertheless, during highly uncertain periods like the pandemic era, it would be beneficial for firms to hold more cash. A growing body of literature shows that it is much more difficult to access loans and financing when the economy is highly uncertain (Gungoraydinoglu et al., 2017; Pástor

& Veronesi, 2013; Bordo et al., 2016). Therefore, firms are most likely to accumulate cash (Denis & Sibilkov, 2010; Harford et al., 2014; Opler et al., 1999). Given the unfavourable economic conditions during the Covid-19 era, firm performance is assumed to be greater for those that hold more cash. Therefore, the baseline hypothesis is:

- H₁ Higher cash holdings positively contribute to firm performance during the Covid-19 era

Next, the study examines whether women's participation in top management affects firm cash holdings during the extreme financial distress of the Covid-19 era. Since CEOs are the key decision-makers among top management, they generally receive the support of executive directors. However, they may also influence corporate liquidity policies through their managerial capabilities and executive power (Cambrea et al., 2020). The upper echelons theory argues that corporate outcomes are largely influenced by the preferences of decision-makers, which, in turn, are affected by their demographic characteristics, such as gender (Hambrick & Mason, 1984). Some past studies integrate both upper echelons and agency theories, demonstrating that women prefer to hold less cash as they have higher ethical values than men (Doan & Iskandar-Datta, 2019; Pierce & Sweeney, 2010).

However, many empirical studies contend that women's involvement in executive roles would tend to be more risk-averse in terms of corporate cash policy by maintaining high liquid reserves to safeguard normal firm operations or avoid unfavourable consequences that may arise from strategic actions (Bernile et al., 2018; Faccio et al., 2016; Elamer & Utham, 2024). It is also believed that the motive of women executives or directors to reserve excess cash is to maintain financial flexibility to reduce the possibility of liquidity deficit and cash flow volatility (Lins et al., 2010; Dittmar et al., 2003). Therefore, given the risk-averse personality of women, and the negative macroeconomic shocks and crises caused by external events such as the Covid-19 pandemic, one could expect that the precautionary motive of saving cash amongst women CEOs and executive directors would be much stronger during the pandemic. Consequently, we postulate that:

- H₂ During the pandemic period, women's executive leadership (CEOs) leads to higher cash holdings

Besides examining whether higher cash holdings delivered value for firm performance during the Covid-19 era and if women's leadership in top management affects cash holdings, the study next examined whether women's participation in top management affects the value of cash holdings on firm performance during the extreme financial distress of the Covid-19 era. The upper echelons literature suggests that women and men act and make decisions differently due to their perceptions and interpretations of risk situations (Fujita et al., 1991; Brody, 1993). Women are said to be more conservative than men in many instances (Byrnes et al., 1999), and less tolerant to risk when it comes to making real financial decisions (Fehr-Duda, et al., 2006; Booth & Nolen, 2012). Croson and Gneezy (2009) add that women tend to be more risk-averse because they are more likely to experience more nervousness, and are less confident and competent when encountering crises or uncertainties. In most cases, men tend to see risky situations as challenges, but women often see them as threats.

More recently, La Rocca et al. (2019) and Dimitropoulos et al. (2019) add that the risk-averse behaviour of women directors might tend to influence the decision to hold cash and hedge against uncertainties caused by the external environment, so as to sustain financial performance and survivorship. When the external environment is tough, such as with the lockdowns and new social norms of Covid-19 era, this perceived behaviour of women against risk and cash-holding decisions may become even stronger. As a result, the precautionary motive of women directors to hold more cash during the pandemic may dominate their monitoring role to avoid management entrenchment, and thus improve firm performance.

With regard to women leaders' influence on firm performance, past studies show that female representation on corporate boards is associated with several benefits, such as a more efficient decision-making process and greater firm value (Elamer & Boulhaga, 2024). Additionally, firms with a substantial presence of women directors also enjoy higher market valuation (Liu et al., 2014) and often outperform financially (Erhardt et al., 2003). Moreover, Luh and Kusi (2023) and Hong and Kim (2022) show that women serving in top management positions—including CEOs, chairpersons, and board members—positively impact listed firm value and performance in the form of net profit margin, return on assets, and gross profit margin. Presumably, the aforementioned characteristics and contributions of women leaders will enable them to help their companies better manage corporate

cash holdings during crisis periods, resulting in better firm performance. In sum, it is anticipated that:

- H₃ Female leadership in the firm affects cash holdings and contributes positively to firm performance during the Covid-19 era

3. Methodology

To examine our research hypotheses, the LSEG Datastream database was used as primary source of information for the firm-level financial data of listed firms in Malaysia. CEO gender data were manually collected from the listed firms’ annual reports. The sample size of this study covered 624 Malaysian listed firms in 2019. The firm performance data were further collected, specifically return on assets (ROA), return on equity (ROE), Tobin’s *q* (TOBINQ), and market-to-book value (MTBV) of sample firms in 2020 and 2021 to observe the impact of corporate cash holdings during the Covid-19 era on subsequent firm performance. Firms from the financial sector were excluded due to different financial structures, accounting practices, and regulation requirements that may cause biased results.

Firstly, a firm performance model was adopted from the literature (Deb et al., 2017; La Rocca & Cambrea, 2019; Pouraghajan et al., 2012; Sardo & Serrasqueiro, 2018), which suggested several control variables that would affect firm performance. Firm age (FIRMAGE), firm size (SIZE), firm risk (RISK), capital expenditure (CAPEX) and financial leverage (LEVERAGE) were included as control variables. A cross-sectional ordinary least squares (OLS) regression was applied to investigate whether cash holding would improve firm performance during the Covid-19 pandemic year, as shown in model (1) below:

$$\text{[REDACTED]} \quad (1)$$

Then, the cash holdings models were used to investigate if cash holdings either increased or decreased under women’s leadership during the pandemic era. The main independent variable was female CEO (FEMALE), which was added into our cross-sectional OLS model to examine whether women’s leadership would influence cash holdings and firm performance during the pandemic era, as seen in model (2) below:

(2)

Finally, model (3) was examined by using cross-sectional OLS regression to observe if women’s leadership affects firm performance in the post-pandemic era by including the variable (FEMALE) and the interaction terms (CASH * FEMALE). Firm performance was proxied by ROA, ROE, and TOBINQ .

(3)

The definition of the variable used in the models is summarised in Table 1.

Table 1: Definition of variables

Variables	Variable name	Description
ROA	Return on assets	Ratio of net income to total assets
ROE	Return on equity	Ratio of net income to equity
TOBINQ	Tobin’s q	Market value of equity plus book value of preferred stock and debt divided by book value of total assets
MTBV	Market-to-book value	Ratio of market value of equity to book value of equity
CASH	Corporate cash holdings	Ratio of corporate cash and cash equivalents to total assets
FEMALE	Female CEO	A dummy variable equals to one if the CEO is a female
FIRMAGE	Firm age	Natural logarithm of the number of years since incorporation
SIZE	Firm size	Natural logarithm of the total assets
RISK	Firm risk	Standard deviation of return on assets
CAPEX	Capital expenditures	Ratio of capital expenditures to total assets
LEVERAGE	Leverage	Ratio of total debts to total assets

4. Results and Discussion

4.1 Descriptive statistics and correlation

Considering the potential of outliers distorting the accuracy of the regression results, all financial data, including ROA20, ROA21, ROE20, ROE21, TOBINQ20, TOBINQ21, MTBV20, and MTBV21, CASH, FIRMAGE, SIZE, RISK, CAPEX, and LEVERAGE were winsorised at the level of

10%–90%. The descriptive statistics of the winsorised data are presented in Table 2. The descriptive statistics showed that Malaysia’s average corporate cash holdings was 0.1350, suggesting that Malaysian firms generally held 13.5% of cash reserves during the Covid-19 era. Post-pandemic firm performance in Malaysia, measured by ROA and ROE, had an average of 0.0181 and 0.0144 in 2020, while the range of ROA fell between -0.0633 and 0.0981, and ROE between -0.1385 and 0.1495. ROA and ROE improved in 2021, which indicates that Malaysian firms generally performed well after the Covid-19 era. Similarly, the average firm value proxied by TOBINQ and MTBV improved from 0.8179 and 0.8484 in 2020 to 0.8663 and 1.0352 in 2021.

The mean value of female CEOs (FEMALE) at 0.0513 suggested that on average, 5.13% of the listed firm samples in Malaysia were managed by women CEOs. The average firm age and firm size were 3.3508 and 13.2546, respectively. This indicated that the average number of years since incorporation of the listed firms in Malaysia was approximately 28.5 years ($e^{3.3508}$), and the average firm size was roughly RM570,689.18 ($e^{13.2546}$). On the other hand, Table 2 reveals that Malaysian firms have

Table 2: Descriptive statistics

Variable	Observation	Mean	Std. dev.	Min.	Max.
ROA20	573	0.0181	0.0481	-0.0633	0.0981
ROA21	570	0.0330	0.0493	-0.0478	0.1147
ROE20	566	0.0144	0.0850	-0.1385	0.1495
ROE21	561	0.0426	0.0908	-0.1129	0.1912
TOBINQ20	622	0.8179	0.5385	0.3120	2.0630
TOBINQ21	622	0.8663	0.4776	0.3640	1.8690
MTBV20	622	0.8484	0.6994	0.2100	2.3900
MTBV21	621	1.0352	0.7757	0.2800	2.7200
CASH	596	0.1350	0.1049	0.0194	0.3435
FEMALE	624	0.0513	0.2207	0	1
FIRMAGE	624	3.3508	0.4625	2.3979	4.6913
SIZE	596	13.2546	1.5034	9.1616	19.0029
RISK	623	0.0824	0.0743	0.0118	0.2412
CAPEX	593	0.0245	0.0244	0.0008	0.0750
LEVERAGE	584	0.1855	0.1455	0.0019	0.4292

Note: The dependent variable is firm performance in 2020 and 2021, measured by returns of assets (ROA20, ROA21), returns on equity (ROE20, ROE21), Tobin’s q (TOBINQ20, TOBINQ21), and market-to-book value (MTBV20, MTBV21). The main dependent variable of interest are cash holding (CASH) and female CEO (FEMALE). The control variables are firm age (FIRMAGE), firm size (SIZE), firm risk (RISK), capital expenditure (CAPEX) and financial leverage (LEVERAGE).

an average risk level of 0.0824, and generally maintain a capital expenditure ratio of 0.0245 and financial leverage ratio of 0.1855.

Next, the correlation analysis was conducted (see Table 3). In general, the magnitude of correlation amongst the variables was below 0.7, except for correlations between the measures of firm performance in 2020 (i.e., ROE20 and ROA20) and 2021 (i.e., ROE21 and ROA21), with a magnitude of 0.96. The correlations between firm values of TOBINQ and MYBV for both years were also at a higher end, with a magnitude of from 0.78 to 0.91. It was noteworthy that the correlations between corporate cash holdings (CASH) and firm performance (ROA and ROE) and correlations between corporate cash holdings (CASH) and firm value (TOBINQ and MTBV) for both years were all positive, ranging from 0.13 to 0.24. In contrast, the correlations amongst the variables of female CEO (FEMALE), firm performance, firm value, and corporate cash holdings were negative in general, ranging from -0.03 to -0.11, implying negative relations amongst these variables. However, Woldrige (2013) states that the correlation results must be interpreted carefully as the correlation analysis does not reflect the causality between variables. Therefore, regression analyses were then performed to observe causality between the variables of interest.

Table 3: Correlation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 ROA20	1.00														
2 ROA21	0.65*	1.00													
3 ROE20	0.96*	0.61*	1.00												
4 ROE21	0.61*	0.96*	0.61*	1.00											
5 TOBINQ20	0.35*	0.36*	0.35*	0.35*	1.00										
6 TOBINQ21	0.29*	0.33*	0.29*	0.33*	0.80*	1.00									
7 MTBV20	0.36*	0.35*	0.35*	0.34*	0.87*	0.72*	1.00								
8 MTBV21	0.30*	0.34*	0.30*	0.32*	0.73*	0.84*	0.81*	1.00							
9 CASH	0.17*	0.15*	0.17*	0.12*	0.18*	0.20*	0.20*	0.21*	1.00						
10 FEMALE	-0.04	-0.09	-0.03	-0.08	-0.07	-0.01	-0.06	-0.01	-0.11	1.00					
11 FIRMAGE	0.00	-0.01	0.02	0.01	-0.12*	-0.14*	-0.09	-0.11*	-0.01	0.07	1.00				
12 SIZE	0.18*	0.16*	0.16*	0.17*	-0.05	-0.17*	0.01	-0.11*	-0.09	-0.07	0.27*	1.00			
13 RISK	0.24*	0.24*	0.24*	0.24*	0.23*	0.17*	0.31*	0.22*	0.16*	-0.03	0.11*	0.46*	1.00		
14 CAPEX	0.28*	0.30*	0.28*	0.32*	0.28*	0.25*	0.28*	0.27*	0.02	-0.00	-0.06	0.17*	0.27*	1.00	
15 LEVERAGE	-0.04	-0.04	-0.08	-0.01	-0.01	-0.05	-0.06	-0.08	-0.40*	-0.04	0.08	0.43*	0.05	0.07	1.00

Note: The dependent variable is firm performance in 2020 and 2021, measured by returns of assets (ROA20 & ROA21), returns on equity (ROE20 & ROE21), Tobin's *q* (TOBINQ20 & TOBINQ21), and market-to-book value (MTBV20 & MTBV21). The main dependent variable of interest are cash holding (CASH) and female CEO (FEMALE). The control variables are firm age (FIRMAGE), firm size (SIZE), firm risk (RISK), capital expenditure (CAPEX) and financial leverage (LEVERAGE). Asterisks * indicate significance at the 1% level.

4.3 *Baseline results*

A cross-section regression on model (1) was first estimated by considering firm performance in 2020 as the dependent variable. This is reported in Table 4 as the first baseline results for H_1 . The coefficient of corporate cash holdings (CASH) showed a significant positive value of 0.0715 and 0.1055 for ROA and ROE, respectively. This denotes that a unit increase in corporate cash holdings during the Covid-19 era corresponded with a 0.0715 and 0.1055 percentage-point increase in the firm ROA and ROE in 2020, respectively. For a firm with an average cash reserve, this effect was associated with a 0.97 ($=0.0715*13.5\%$) and 1.42 ($=0.1055*13.5\%$) percentage-point increase in ROA and ROE, respectively. This finding is consistent with past studies, emphasising the benefits of holding cash during uncertain periods to avoid the expensive cost of fundraising, lower the possibility of financial distress, and seize future growth opportunities (Gungoraydinoglu et al., 2017; Fresard, 2010; Bates et al., 2009; Myers, 1984).

The study next analysed whether women CEOs affect corporate cash holdings differently during the Covid-19 era. This is reported in Table 4 as the second baseline results for H_2 . Interestingly, a full sample showed that firms managed by women CEOs generally hold less cash, or 0.0454 percentage points less than male CEOs during the Covid-19 era. A similar result was found by performing regression on sample firms matched through the propensity score matching (PSM). This finding was surprising and inconsistent with past arguments, which advocated the risk-averse personality of women CEOs. Nevertheless, this could also imply either that women CEOs tended to be more aware of the cost of holding excessive cash (Opler et al., 1999), or that they have higher ethical values in not holding too much cash for their interests, as explained by agency theory (Xu et al., 2019; Doan & Iskandar-Datta, 2019; Pierce & Sweeney, 2010).

For H_3 , which is to observe whether holding less cash by female CEOs leads to greater or worse outcomes, the study interacted the variable of women CEOs with corporate cash holdings during the Covid-19 era, and regressed with firm performance in 2020. For the third baseline result, it was seen that in columns 5 and 6 the interaction term CASH*FEMALE does not show a significant result; however, a significant positive result is shown in columns 7 and 8. This suggests that the cash management of women CEOs during the pandemic period led to better firm performance

than firms with similar characteristics managed by male CEOs. For a firm holding an average cash reserve, female CEOs tended to enhance the positive impact of corporate cash holdings on firm ROA and ROE in the following year by 7.17 (=0.5313*13.5%) and 5.24 (=0.3883*13.5%) percentage points respectively, as compared to similarly matched firms managed by male CEOs. This implies that, despite female CEOs reserving less cash, they could generate more returns for their firms with every unit of cash being reserved as compared to male CEOs. This is consistent with H₃, implying that female leadership affects cash holdings and contributes positively to firm performance (Luh & Kusi, 2023; Hong & Kim, 2022; Liu et al., 2014).

It is noteworthy that, the values of the variance inflation factor (VIF) reported in Table 4 below were within the range of 1.26 to 2.06. This suggested that our cross-sectional OLS models were free from multicollinearity issues, as the VIF values were significantly below the threshold value of 10 (Gujarati & Porter, 2009).

Table 4: Baseline results based on firm performance in 2020

	H ₁		H ₂		H ₃			
	ROA20	ROE20	CASH	CASH	ROA20	ROE20	ROA20	ROE20
CASH	0.0715*** (0.0209)	0.1055*** (0.0375)			0.0701*** (0.0213)	0.1050*** (0.0382)	-0.1783*** (0.0642)	0.0797 (0.0999)
FEMALE			-0.0454*** (0.0184)	-0.0517*** (0.0144)	-0.005 (0.0136)	-0.0014 (0.0242)	-0.0284** (0.0130)	-0.0277 (0.0229)
CASH*FEMALE					0.0308 (0.1203)	-0.0105 (0.2140)	0.5313*** (0.1016)	0.3883*** (0.1698)
FIRMAGE	-0.0018 (0.0044)	-0.0008 (0.0079)	0.0099 (0.0092)	0.018 (0.0186)	-0.0017 (0.0045)	-0.0007 (0.0080)	-0.0478*** (0.0126)	-0.0640*** (0.0243)
SIZE	0.0040** (0.0018)	0.0076** (0.0032)	-0.0009 (0.0037)	0.0174* (0.0089)	0.0040** (0.0018)	0.0076** (0.0032)	0.0171*** (0.0045)	0.0103 (0.0082)
RISK	0.0580* (0.0311)	0.0999* (0.0554)	0.2247*** (0.0639)	0.6106*** (0.1480)	0.0576* (0.0312)	0.1002* (0.0556)	-0.0238 (0.0823)	0.3135** (0.1313)
CAPEX	0.4626*** (0.0842)	0.8514*** (0.1511)	0.1085 (0.1734)	0.262 (0.3226)	0.4616*** (0.0846)	0.8523*** (0.1517)	0.4171** (0.1789)	0.5185 (0.3127)
LEVERAGE	-0.0154 (0.0160)	-0.0642** (0.0291)	-0.2913*** (0.0303)	-0.3020*** (0.0703)	-0.0155 (0.0161)	-0.0644** (0.0292)	-0.0305 (0.0392)	0.0645 (0.0696)
CONSTANT	-0.0273 (0.0326)	-0.1062* (0.0580)	0.2249*** (0.0669)	-0.2021* (0.1215)	-0.0267 (0.0327)	-0.1060* (0.0582)	-0.1574** (0.0659)	0.1421 (0.0962)
N	559	552	560	112	559	552	104	104
Adjusted R ²	0.1501	0.1444	0.2432	0.4563	0.1472	0.1412	0.4331	0.3066
VIF (Multicollinearity)	1.35	1.36	1.26	1.45	1.62	1.63	2.03	1.91
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSM	No	No	No	Yes	No	No	Yes	Yes

Note: The dependent variable is firm performance in 2020 and 2021, measured by returns of assets (ROA20, ROA21), returns on equity (ROE20, ROE21), Tobin's q (TOBINQ20, TOBINQ21), and market-to-book value (MTBV20, MTBV21). The main dependent variable of interest are cash holding (CASH) and female CEO (FEMALE). The control variables are firm age (FIRMAGE), firm size (SIZE), firm risk (RISK), capital expenditure (CAPEX) and financial leverage (LEVERAGE). N is the number of observations, while PSM refers to propensity score matching. H₁ is tested with Model 1, H₂ is tested with Model 2, while H₃ is tested with Model 3.

4.3 *Robustness test 1: Replacing firm performance in 2021*

To test the robustness of the findings for models (1) and (3), the dependent variable with firm performance in 2021 was replaced. Table 5 shows that the coefficient of cash holdings (CASH) is statistically significant and positively related to firm ROA and ROE in 2021. This suggests that a unit increase in corporate cash holdings during the Covid-19 era consistently improved the firm ROA and ROE by 0.0599 and 0.095 percentage points in 2021. On the other hand, columns 3 to 6 show that the interaction term CASH*FEMALE was insignificant with the firm ROA and ROE in 2021, with or without propensity score matching. This suggests that female CEOs generally do not sustain or enhance the positive impact of Covid-19 era cash reserves on firm performance for a long period.

Table 5: Robustness test using firm performance in 2021

	H ₁		H ₃		H ₃	
	ROA21	ROE21	ROA21	ROE21	ROA21	ROE21
CASH	0.0599*** (0.0214)	0.0950** (0.0399)	0.0582*** (0.0218)	0.0955** (0.0404)	0.0939 (0.0737)	0.2228 (0.1419)
FEMALE			-0.0024 (0.0138)	0.0098 (0.0261)	-0.0201 (0.0163)	-0.0438 (0.0296)
CASH*FEMALE			-0.0899 (0.1216)	-0.2926 (0.2267)	0.0929 (0.1096)	0.2112 (0.2303)
FIRMAGE	-0.0033 (0.0045)	-0.001 (0.0083)	-0.0025 (0.0045)	0.0007 (0.0084)	-0.0463*** (0.0155)	-0.0532** (0.0230)
SIZE	0.0037** (0.0018)	0.0061* (0.0034)	0.0035* (0.0018)	0.0058* (0.0034)	0.0043 (0.0053)	0.0146* (0.0086)
RISK	0.0649** (0.0316)	0.1149** (0.0584)	0.0666** (0.0317)	0.1199** (0.0585)	-0.0135 (0.0935)	-0.2204 (0.1607)
CAPEX	0.4485*** (0.0857)	0.8981*** (0.1591)	0.4545*** (0.0860)	0.9155*** (0.1594)	0.4538** (0.2201)	0.1277 (0.3362)
LEVERAGE	-0.015 (0.0165)	-0.015 (0.0309)	-0.0161 (0.0165)	-0.0173 (0.0309)	0.0053 (0.0536)	0.1794** (0.0725)
CONSTANT	-0.0667** (0.0332)	-0.0375 (0.0613)	-0.0622* (0.0334)	-0.0376 (0.0613)	0.1579** (0.0662)	-0.1127 (0.1345)
N	545	538	545	538	104	104
Adjusted R ²	0.1625	0.1617	0.1621	0.1625	0.165	0.2602
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes
PSM	No	No	No	No	Yes	Yes

Note: The dependent variable is firm performance in 2020 and 2021, measured by returns of assets (ROA20, ROA21), returns on equity (ROE20, ROE21), Tobin's *q* (TOBINQ20, TOBINQ21), and market-to-book value (MTBV20, MTBV21). The main dependent variable of interest are cash holding (CASH) and female CEO (FEMALE). The control variables are firm age (FIRMAGE), firm size (SIZE), firm risk (RISK), capital expenditure (CAPEX) and financial leverage (LEVERAGE). N is the number of observations, while PSM refers to propensity score matching. H₁ is tested with Model 1, while H₃ is tested with Model 3.

4.4 Robustness test 2: Replacing with market-based firm performance

In further analysis, the market-based proxies TOBINQ and MTBV as alternative measures for firm performance were considered. The regression results are shown in Table 6. Qualitatively, the results accord to those shown in Table 4 and Table 5, where corporate cash holdings are statistically significantly and positively related to firm value (TOBINQ and MTBV) for both years. Similar to Table 4, the interaction term of female CEOs and corporate cash holdings (CASH*FEMALE) were statistically significant and positively related to the firm in 2020, except for MTBV. Unlike Table 5, the interaction term CASH*FEMALE was statistically significant and positively related to firm TOBINQ in 2021. The interaction results in Table 5 suggest that female CEOs enhanced Covid-19 cash reserves on firm Tobin's q for 2020 and 2021. The overall results imply that corporate cash holdings increase market-based firm performance, and women CEOs tend to play a significant role in enhancing the positive impact of cash holdings on firm value, except for market-to-book value.

Table 6: Further issues on firm value via TOBINQ and MTBV

	H ₁		H ₃		H ₁		H ₃	
	TOBINQ20	TOBINQ21	TOBINQ20	TOBINQ21	MTBV20	MTBV21	MTBV20	MTBV21
CASH	0.6619*** (0.2253)	0.6937*** (0.1942)	1.5941*** (0.5648)	0.7338 (0.5750)	0.8519*** (0.2917)	0.9373*** (0.3186)	2.6258*** (0.8471)	1.1451 (0.8985)
FEMALE			-0.2488** (0.1200)	-0.1408 (0.1222)			-0.2356 (0.1800)	0.0897 (0.2088)
CASH*FEMALE			2.2292** (0.9921)	1.7929* (1.0101)			1.8387 (1.4880)	-1.2438 (1.6377)
FIRMAGE	-0.0596 (0.0474)	-0.0273 (0.0409)	-0.3719*** (0.1093)	-0.1654 (0.1112)	-0.0777 (0.0614)	-0.0114 (0.0670)	-0.3163* (0.1639)	-0.3134 (0.1917)
SIZE	-0.0578*** (0.0191)	-0.0892*** (0.0164)	-0.0337 (0.0492)	-0.1291** (0.0501)	-0.0488** (0.0247)	-0.1249*** (0.0270)	-0.0587 (0.0738)	-0.087 (0.0778)
RISK	1.5538*** (0.3357)	1.2518*** (0.2895)	-0.1494 (0.8579)	0.1968 (0.8735)	2.7182*** (0.4348)	2.5141*** (0.4747)	-0.2667 (1.2867)	6.0453*** (1.1972)
CAPEX	4.1234*** (0.9007)	3.4469*** (0.7767)	-3.6816** (1.8245)	-3.6865* (1.8576)	5.0583*** (1.1664)	6.0869*** (1.2735)	-3.1698 (2.7365)	-6.6119*** (3.2594)
LEVERAGE	0.4567*** (0.1711)	0.4361*** (0.1475)	1.3331*** (0.4018)	0.8022* (0.4091)	0.1756 (0.2215)	0.3713 (0.2419)	1.8244*** (0.6026)	1.4420*** (0.6318)
CONSTANT	1.8654*** (0.3532)	2.2466*** (0.3046)	2.9871*** (0.6464)	3.5914*** (0.6581)	1.7723*** (0.4574)	2.5584*** (0.5017)	3.4956*** (0.9695)	2.8418*** (0.9906)
N	582	582	112	112	582	581	112	112
Adjusted R ²	0.2038	0.2300	0.3662	0.3737	0.2047	0.2242	0.2682	0.3390
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSM	No	No	Yes	Yes	No	No	Yes	Yes

Note: The dependent variable is firm performance in 2020 and 2021, measured by returns of assets (ROA20, ROA21), returns on equity (ROE20, ROE21), Tobin's q (TOBINQ20, TOBINQ21), and market-to-book value (MTBV20, MTBV21). The main dependent variable of interest are cash holding (CASH) and female CEO (FEMALE). The control variables are firm age (FIRMAGE), firm size (SIZE), firm risk (RISK), capital expenditure (CAPEX) and financial leverage (LEVERAGE). N is the number of observations, while PSM refers to propensity score matching. H₁ is tested with Model 1, while H₃ is tested with Model 3.

4.5 Robustness test 3: Replacing with firm performance in dummy approach

Until this point, the findings showed that corporate cash holdings during the Covid-19 era and women CEOs significantly impacted firm performance and firm value in 2020. To gain a better insight into the robust association between these variables, models (1) and (3) were re-examined with probit regression by setting the firm performance and firm value variables as dummy variables. ROA and ROE in 2020 were redefined, with each dummy variable being 1 if the proxy was positive and 0 otherwise. TOBINQ and MTBV in 2020 were redefined, with each dummy variable equalling 1 if the measure is greater than their mean value, and 0 otherwise. The results of the probit regression are presented in Table 7. The coefficient of corporate cash holdings was significantly positively related to firm ROA, ROE, TOBINQ and MTBV, supporting our notion that higher cash holdings during the Covid-19 era were more likely to generate positive firm performance

Table 7: Further issues using dummy approach with probit regression

	H ₁				H ₃			
	ROA20	ROE20	TOBINQ20	MTBV20	ROA20	ROE20	TOBINQ20	MTBV20
CASH	2.5577** (1.0672)	2.1807** (1.0260)	2.0854* (1.1259)	2.3000** (1.0742)	-16.3477*** (5.7054)	-10.4841** (4.2299)	7.3071 (7.0131)	8.6660* (4.8226)
FEMALE					-6.7656*** (1.7082)	-5.5969*** (1.2644)	-2.6558** (1.2415)	-1.2506 (1.0043)
CASH*FEMALE					38.0385*** (11.6604)	38.9092*** (11.1543)	29.7546*** (9.6280)	13.0114* (6.8846)
FIRMAGE	-0.131 (0.2263)	-0.146 (0.2154)	-0.3724 (0.2488)	-0.4468* (0.2426)	-3.4208*** (1.1212)	-3.2108*** (0.9822)	-4.8228*** (1.5623)	-2.0901** (0.9036)
SIZE	0.3081*** (0.0962)	0.1704* (0.0879)	-0.1532 (0.0976)	-0.0103 (0.0922)	0.7679* (0.4273)	0.5467 (0.3429)	1.4532** (0.5998)	0.6298 (0.3977)
RISK	-0.1723 (1.6496)	0.9136 (1.5698)	4.9568*** (1.6328)	6.7817*** (1.5594)	15.0278* (8.2868)	17.0577** (7.4614)	1.1104 (8.6949)	-9.5172 (7.2676)
CAPEX	21.1428*** (4.9120)	21.9586*** (4.5783)	12.6113*** (4.2907)	10.9312*** (4.1815)	-5.8102 (16.6740)	-18.7713 (15.5968)	-51.0222** (19.9555)	-11.6846 (12.9543)
LEVERAGE	0.3999 (0.8085)	-1.0545 (0.7676)	0.7848 (0.8847)	-0.4264 (0.8539)	2.1142 (3.4223)	1.9506 (2.9446)	7.1914* (4.1275)	3.9157 (3.1353)
CONSTANT	-3.9486*** (1.2959)	-2.0363* (1.1997)	1.1794 (1.3215)	-0.3217 (1.2592)	5.8487 (4.8733)	6.6232 (4.1068)	-6.2729 (5.8597)	-3.411 (4.4166)
N	577	582	548	582	106	106	84	88
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSM	No	No	No	No	Yes	Yes	Yes	Yes

Note: The dependent variable is firm performance in 2020 and 2021, measured by returns of assets (ROA20, ROA21), returns on equity (ROE20, ROE21), Tobin's *q* (TOBINQ20, TOBINQ21), and market-to-book value (MTBV20, MTBV21). The main dependent variable of interest are cash holding (CASH) and female CEO (FEMALE). The control variables are firm age (FIRMAGE), firm size (SIZE), firm risk (RISK), capital expenditure (CAPEX) and financial leverage (LEVERAGE). N is the number of observations, while PSM refers to propensity score matching. H₁ is tested with Model 1, while H₃ is tested with Model 3.

and firm value in the following year. Likewise, the interaction term CASH*FEMALE showed a significant and positive coefficient across the ROA, ROE, TOBINQ and MTBV columns. This implies that women CEOs played a significant role in managing cash reserves during the Covid-19 era, which contributed to positive firm performance and firm value in the following year.

5. Conclusion and Policy Implication

The overall results indicate that corporate cash holdings during the Covid-19 era significantly enhanced firm performance in the following years. This finding corroborates the importance of cash holdings during uncertain periods in sustaining firm survival or performance. Female CEOs also played a significant role in influencing corporate cash holdings and improving firm outcomes. The effect of corporate cash holdings in improving firm performance and firm value was shown to be more pronounced when the cash was managed by a female CEO. This aligns with upper echelons theory, which essentially assumes that corporate outcomes are largely influenced by the preferences of the CEO, which in turn are affected by gender (Hambrick & Mason, 1984).

While prior research often highlights the risk-averse nature of female leaders, our findings suggest a more nuanced view, suggesting that female CEOs in Malaysia have different perceptions and interpretations of risk situations (Fujita et al., 1991; Brody, 1993) by holding less cash in firms during the Covid-19 era, yet managing it more efficiently and generating greater firm performance compared to their male counterparts. In conclusion, the study findings imply that maintaining sufficient cash reserves is crucial for firm resilience during crises, and also highlights the positive impact of women's leadership in corporate cash management. As such, policymakers should strongly encourage gender diversity in the top management or promote women's participation on corporate boards through governance reforms to enhance corporate decision-making and risk management during uncertain times.

The findings of the study also imply that women leaders, particularly CEOs, not only enhance the value of cash holdings on firm performance during periods of extreme financial distress, but also help to raise the perception of management integrity. For investors, firms with diverse top

executives, particularly those led by women CEOs, may provide greater confidence by offering more stable returns and greater resilience, especially during uncertain periods.

There were several limitations in this study which may offer opportunities for future research. Firstly, our analysis only focuses on listed firms in Malaysia, which may limit the generalisability of findings to other countries with different economic and cultural contexts. Future research could expand the sample to include firms from different countries to explore potential variations in cash-holding decisions and the impact of female leadership during crisis periods. Additionally, given the data constraint, this study only focused on cross-sectional data from 2019 and observed post-pandemic firm performance in 2020 and 2021, limiting the ability to assess longer-term trends in cash holdings and firm performance. Future studies could adopt a longitudinal approach to observe these dynamics over a longer period. Lastly, while this study examined the role of women CEOs, specifically due to the limitation of data, future research could explore the broader impact of gender diversity across different leadership levels, such as directors or other executive levels, to understand the decision-making of men and women leaders across different levels of leadership during uncertain periods.

Author Statement

Khong Jiunn-Shyan: Data Collection, Formal Analysis, Writing – Original draft. **Foong Swee-Sim:** Conceptualisation, Design of methodology, Writing – Original draft.

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